TFT LCD Approval Specification

MODEL NO.: N150X7 - L01

Customer : Fujitsu

Approved by : _____

Note :

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval
陳 94. 6. 2 永一	林 94. 6. 2 添仁

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 3.0	Feb. 03,'05	All	All	Approval specification was first issue for Fujitsu.
Ver 3.1	Apr. 15,'05	4	1.4	Modify Depth of the module: Typ.: 9.9~7.2→9.8~7.2 Max.: 10.2~7.5→10.1~7.5
		23	7.2	Modify the optical spec. Rx:0.647→0.641,Ry:0.334→0.348 Gx:0.283→0.285,Gy:0.612→0.604 Bx:0.143→0.143,By:0.092→0.067 T_R(max):10ms→9ms, T_F(max):20ms→17ms
Ver 3.2	Jun. 02,'05	4,32	1.4,drawing	Modify Depth of the module: Typ.: 9.8~7.2→9.9~7.2 Max.: 10.1~7.5→10.2~7.5

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N150X7 - L01 is a 15.0" TFT Liquid Crystal Display module with two CCFL Backlight units and 30 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and High Brightness
- XGA (1024 x 768 pixels) resolution
- DE only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- Two CCFLs

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

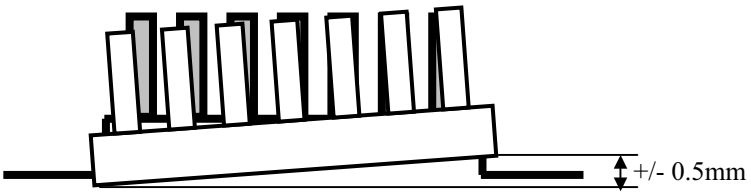
Item	Specification	Unit	Note
Active Area	304.1 (H) x 228.1 (V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	307.8 (H) x 231.6 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.297 (H) x 0.297 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (2H), Glare Type, Reflection< 3%	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	316.8	317.3	317.8	mm	(1)
	Vertical (V)	241.5	242	242.5	mm	
	Depth (D)	-	9.9~7.2	10.2~7.5	mm	
Weight		-	800	830	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Storage Humidity	H_{ST}	5	95		
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Operating Humidity	H_{OP}	5	95		
Shock (Non-Operating)	H_{ST}	-	200	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	2	G	(4), (5)
MTBF: 50000 Hr (except for backlight lamp)					

Note (1) Temperature and relative humidity range is shown below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

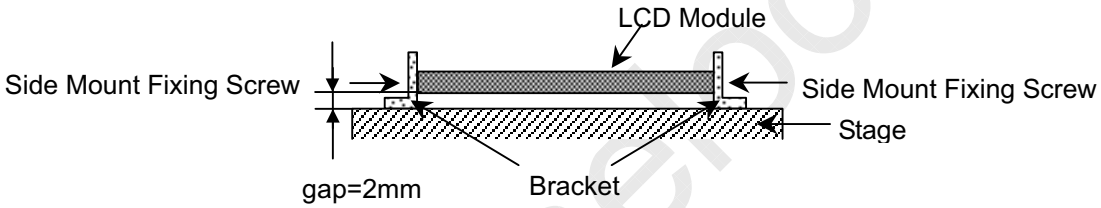
(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The ambient temperature means the temperature of panel surface.

Note (3) 2ms, half sine wave, 1 times for ± X, ± Y, ± Z.

Note (4) 10 ~ 500 Hz, 30 min/cycle,(4)cycles for each X, Y, Z axis. The fixing condition is shown as below:



Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	2.5K	V_{RMS}	(1), (2), I_L = 6.0 mA
Lamp Current	I_L	-	6.5	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	-	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

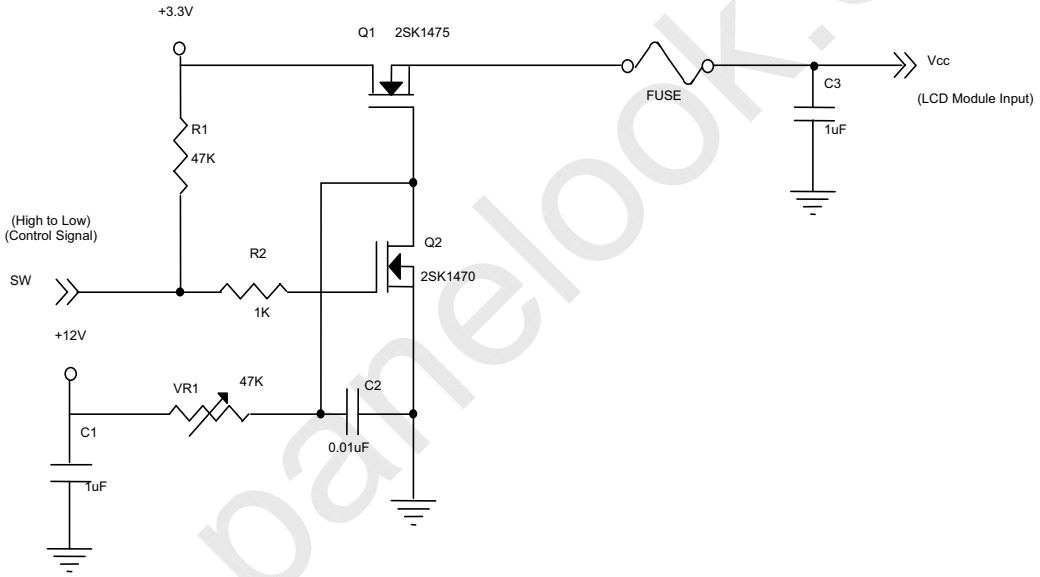
Ta = 25 ± 2 ºC

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	50		mV	-
Rush Current		I_{RUSH}	-		1.5	A	(2)
Power Supply Current	White	Lcc	-	280	330	mA	(3)a
	Black		-	330	400	mA	(3)b
Logical Input Voltage	"H" Level	V_{IL}	-	-	+100	mV	-
	"L" Level	V_{IH}	-100	-	-	mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-

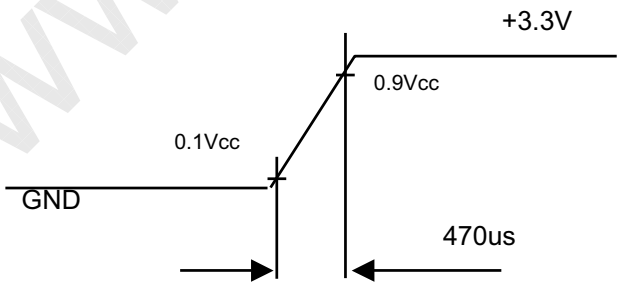
Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

:



Vcc rising time is 470us



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

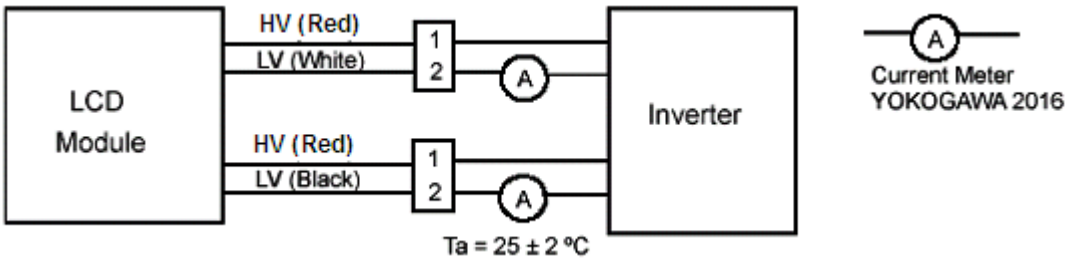
Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	585	650	715	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	2.0	6.0	6.5	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-		1020(25 °C)	V_{RMS}	(2)
		-		1175 (0 °C)	V_{RMS}	(2)
Operating Frequency	F_L	40	60	80	KHz	(3)
Lamp Life Time	L_{BL}	12,500	17,500		Hrs	(5)
Power Consumption	P_L	-	7.8	-	W	(4), I_L = 6.0 mA

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and I_L = 6.5 mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

The output of the inverter must have symmetrical (negative and positive) voltage waveform and

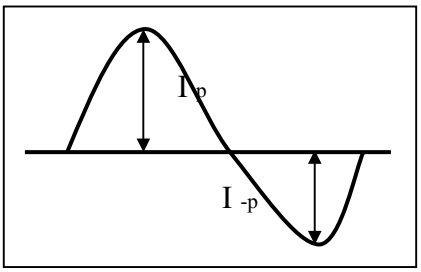
symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter, which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2} \pm 10\%$;

c. The ideal sine wave form shall be symmetric in positive and negative polarities.



* Asymmetry rate:

$$| I_p - I_{-p} | / I_{rms} * 100\%$$

* Distortion rate

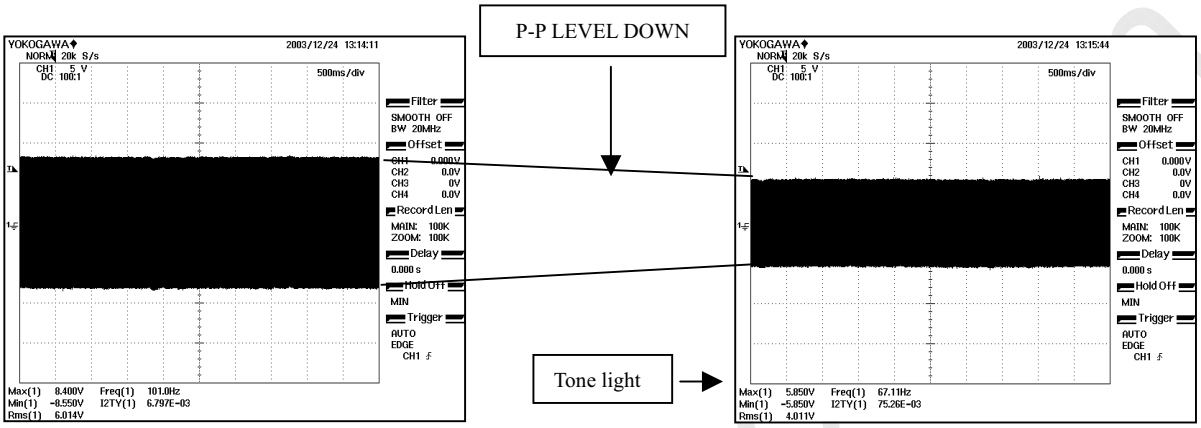
$$I_p \text{ (or } I_{-p}) / I_{rms}$$

Note (7) About operating current min 2.0mA , lamp maker has some advice as below:

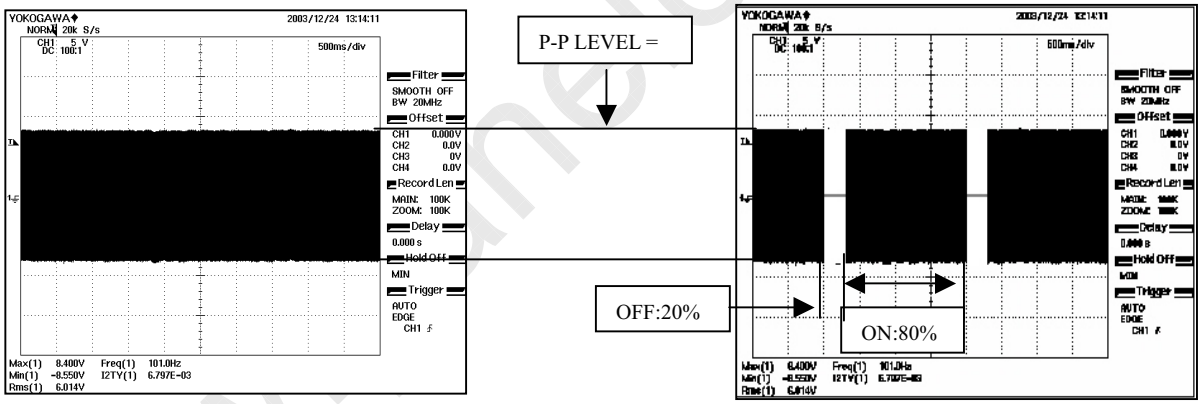
(Reference) Light quantity adjustment method

Explanation and comparison of the kind of tone light:

① Lamp current wave-like by the adjustment of the current.



② Lamp current wave-like by the adjustment of the burst.



Comparative table

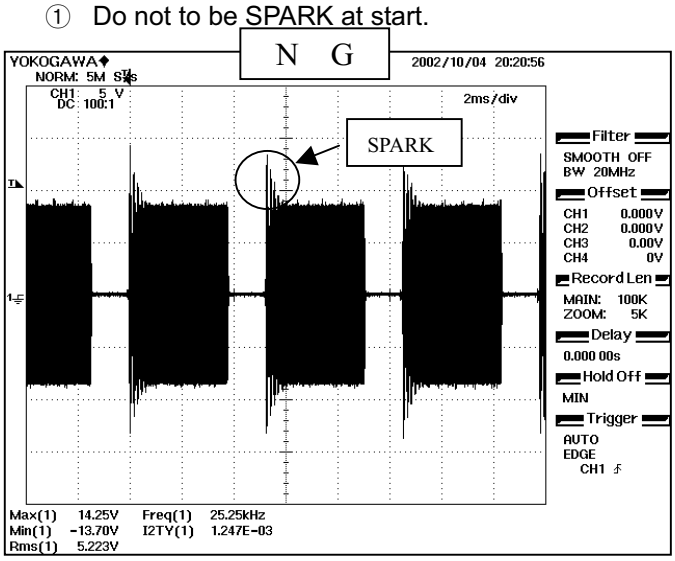
Method	Backlight efficiency (INV＋LAMP)	Tone light rate (%)	Circuitry
①current	Good (75 % ～ 85%)	58	Complicated
②burst	Bad (65 % ～ 75%)	10	Easy

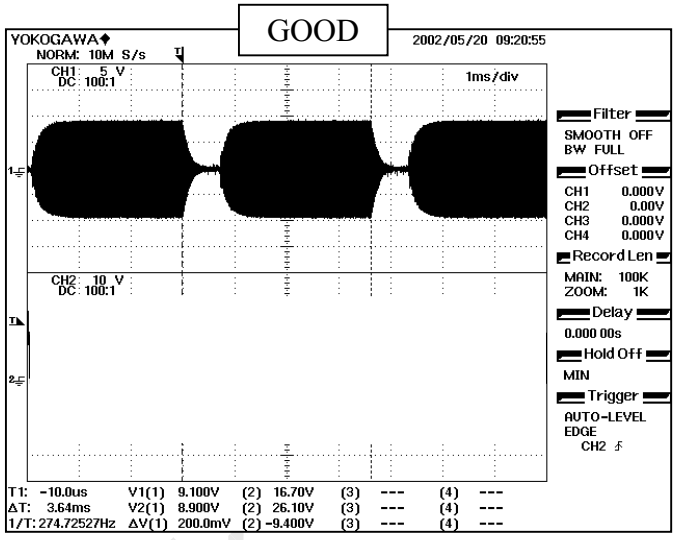
Method of case that Lamp current MIN2.0mA is controlled.

It is the setting of minimum 2mA (MIN) to Lamp current 6mA (TYP) in the lamp specification. The burst is excellent for circuitry. The marker proposes that pays attention to the following contents.

The attention point of the light with a touch of the burst:

① Do not to be SPARK at start.

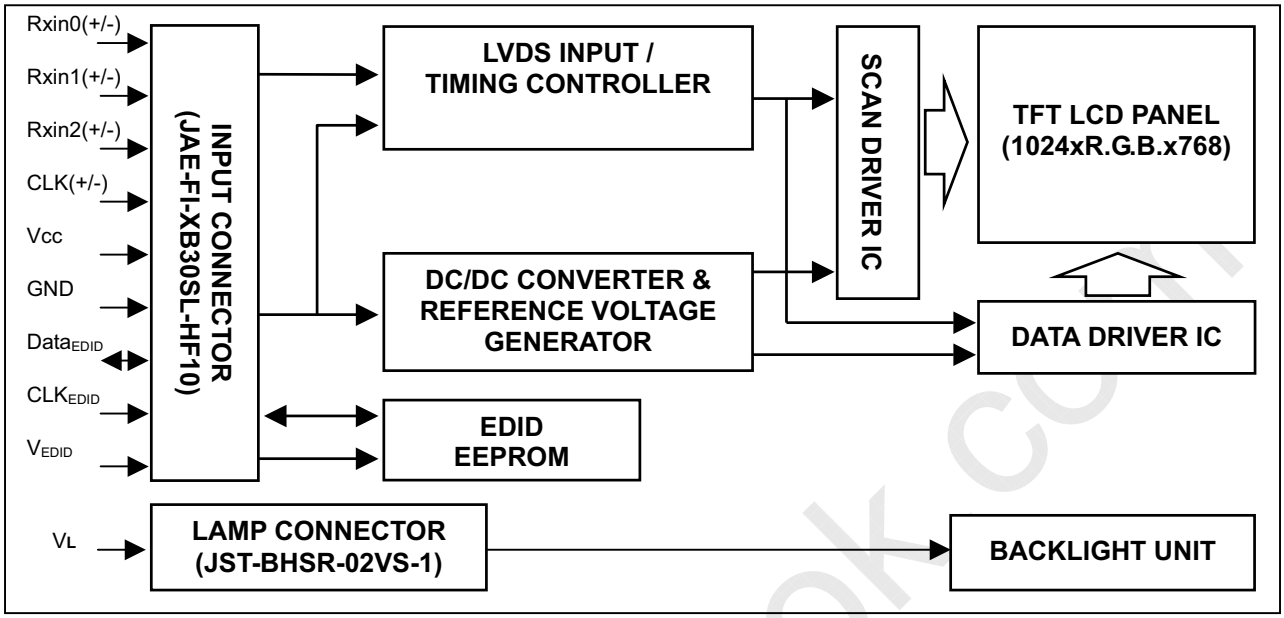




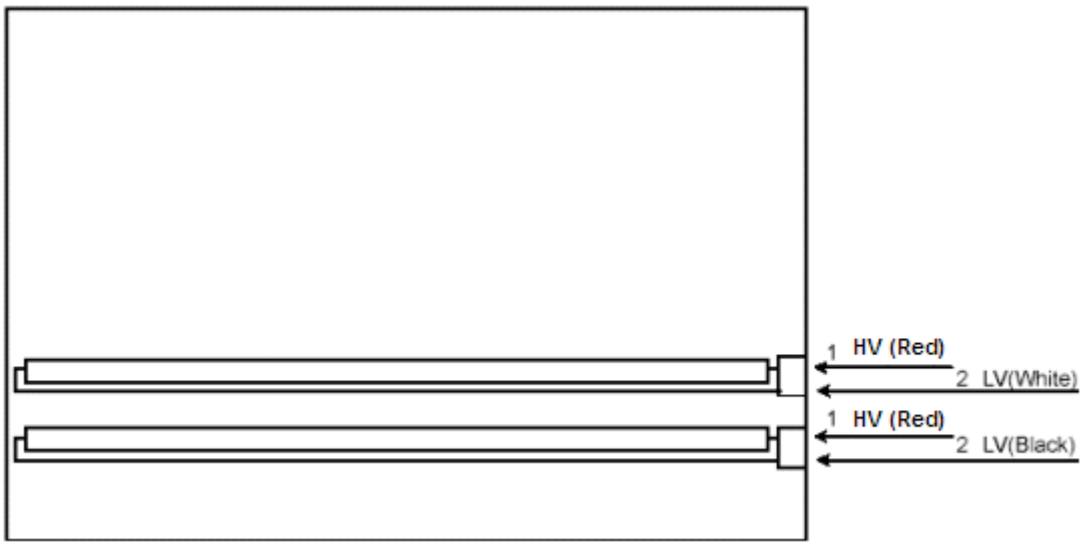
PWM frequency does so that the frequency that is not able to divide the fixed number time, fixed number to lamp drive frequency is selected. (It is due to resonance noise occurrence prevention.) Even the frequency that is using it for LCD avoids selecting it.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V_{EDID}	DDC 3.3V Power		
5	NC	Non-Connection		
6	CLK_{EDID}	DDC Clock		
7	$DATA_{EDID}$	DDC Data		-
8	Rxin0-	LVDS Differential Data Input	Negative	R0~R5,G0
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	G1~G5,B0,B1
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	B2~B5,DE,Hsync,Vsync
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		
17	CLK-	LVDS Clock Data Input	Negative	LVDS Level
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	Non-Connection		
21	NC	Non-Connection		
22	Vss	Ground		
23	NC	Non-Connection		
24	NC	Non-Connection		
25	Vss	Ground		
26	NC	Non-Connection		
27	NC	Non-Connection		
28	Vss	Ground		
29	NC	Non-Connection		
30	NC	Non-Connection		

Note (1) Connector Part No.: JAE-FI-XB30SL-HF10

Note (2) User's connector Part No: JAE-FI-X30C2L

Note (3) The first pixel is even.

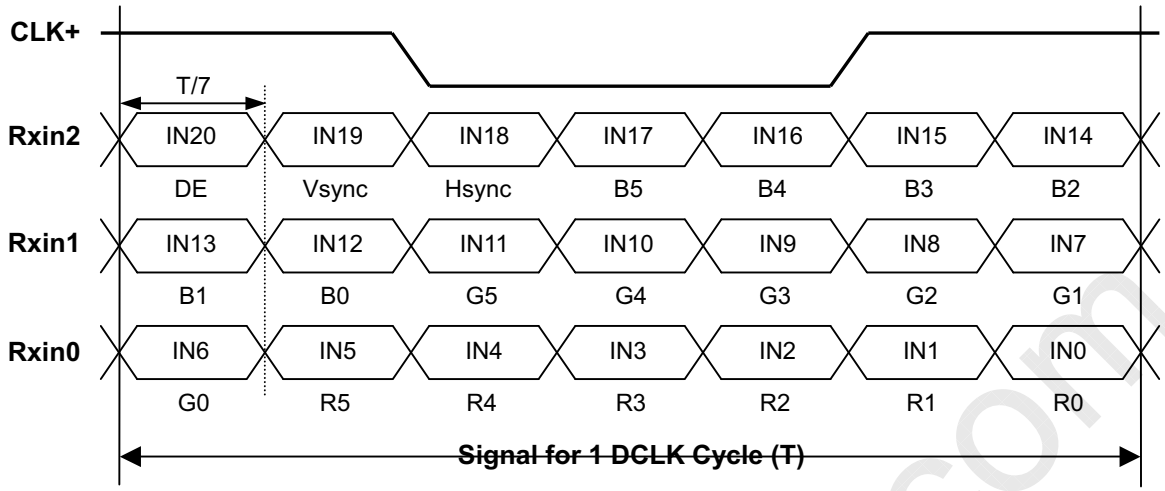
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Red
2	LV	Ground	White
1	HV	High Voltage	Red
2	LV	Ground	Black

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats support displays as defined in the VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name (“APP”)	06	00000110
9	9	EISA ID manufacturer name (Compressed ASCII)	10	00010000
10	0A	ID product code (N150X7-L01)	07	00000111
11	0B	ID product code (hex LSB first,N150X7-L01)	15	00010101
12	0C	ID S/N (fixed “0”)	00	00000000
13	0D	ID S/N (fixed “0”)	00	00000000
14	0E	ID S/N (fixed “0”)	00	00000000
15	0F	ID S/N (fixed “0”)	00	00000000
16	10	Week of manufacture (fixed “0EH”)	00	00000000
17	11	Year of manufacture (fixed “2004”)	00	00000000
18	12	EDID structure version # (“1”)	01	00000001
19	13	EDID revision # (“3”)	03	00000011
20	14	Video I/P definition (“digital”)	80	10000000
21	15	Max H image size (“28 cm”)	1C	00011100
22	16	Max V image size (“21 cm”)	15	00010101
23	17	Display Gamma (Gamma = ” 2.2”)	78	01111000
24	18	Feature support (“RGB, preferred timing”)	0A	00001010
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	EB	11101011
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	A5	10100101
27	1B	Red-x (Rx = “0.647”)	A5	10100101
28	1C	Red-y (Ry = “0.334”)	55	01010101
29	1D	Green-x (Gx = ”0.283”)	48	01001000
30	1E	Green-y (Gy = ”0.612”)	9C	10011100
31	1F	Blue-x (Bx = ”0.143”)	24	00100100
32	20	Blue-y (By = ”0.092”)	17	00010111
33	21	White-x (Wx = ”0.313”)	50	01010000
34	22	White-y (Wy = ”0.329”)	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2 (1024x768@60Hz)	08	00001000
37	25	Manufacturer’s reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

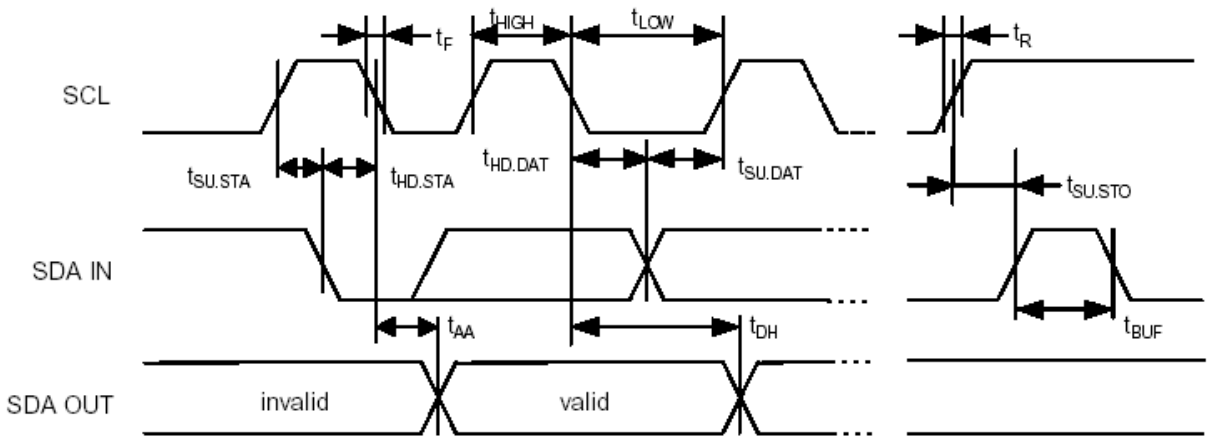
Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock (“65 MHz”)	64	01100100
55	37	# 1 Pixel clock (hex LSB first)	19	00011001
56	38	# 1 H active (“1024”)	00	00000000
57	39	# 1 H blank (“320”)	40	01000000
58	3A	# 1 H active: H blank (“1024 : 320”)	41	01000001
59	3B	# 1 V active (” 768”)	00	00000000
60	3C	# 1 V blank (” 38”)	26	00100110
61	3D	# 1 V active: V blank (” 768 : 38”)	30	00110000
62	3E	# 1 H sync offset (” 24”)	18	00011000
63	3F	# 1 H sync pulse width (” 136”)	88	10001000
64	40	# 1 V sync offset: V sync pulse width (” 3 : 6”)	36	00110110
65	41	# 1 H sync offset: H sync pulse width : V sync offset : V sync width (” 24 : 136 : 3 : 6”)	00	00000000
66	42	# 1 H image size (” 285 mm”)	1D	00011101
67	43	# 1 V image size (” 214 mm”)	D6	11010110
68	44	# 1 H image size: V image size (” 285 : 214”)	10	00010000
69	45	# 1 H boarder (” 0”)	00	00000000
70	46	# 1 V boarder (” 0”)	00	00000000
71	47	# 1 Flags (” Non-Interlace, Non-Stereo, Digital Separate”)	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name “N150X7” , ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of string (“N”)	4E	01001110
78	4E	# 2 2nd character of string (“1”)	31	00110001
79	4F	# 2 3rd character of string (“5”)	35	00110101
80	50	# 2 4th character of string (“0”)	30	00110000
81	51	# 2 5th character of string (“X”)	58	01011000
82	52	# 2 6th character of string (“7”)	37	00110111
83	53	# 2 New line character # 2 indicates end of ASCII string	20	00100000
84	54	# 2 Padding with “Blank” character	20	00100000
85	55	# 2 Padding with “Blank” character	20	00100000

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
86	56	# 2 Padding with "Blank" character	20	00100000
87	57	# 2 Padding with "Blank" character	20	00100000
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	# 3 Flag	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Flag	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Model Name "N150X7", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("N")	4E	01001110
96	60	# 3 2nd character of string ("1")	31	00110001
97	61	# 3 3rd character of string ("5")	35	00110101
98	62	# 3 4th character of string ("0")	30	00110000
99	63	# 3 5th character of string ("X")	58	01011000
100	64	# 3 6th character of string ("7")	37	00110111
101	65	# 3 New line character # 3 indicates end of ASCII string	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	# 4 Flag	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Flag	00	00000000
111	6F	Data Type Tag: ASCII String	FC	11111100
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("C")	43	01000011
114	72	# 4 2nd character of name ("o")	6F	01101111
115	73	# 4 3rd character of name ("l")	6C	01101100
116	74	# 4 4th character of name ("o")	6F	01101111
117	75	# 4 5th character of name ("r")	72	01110010
118	76	# 4 6th character of name (<space>)	20	00100000
119	77	# 4 7th character of name ("L")	4C	01001100
120	78	# 4 8th character of name ("C")	43	01000011
121	79	# 4 9th character of name ("D")	44	01000100
122	7A	# 4 New line character # 4 indicates end of Monitor name	0A	00001010
123	7B	# 4 Padding with "Blank" character	20	00100000
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	F9	11111001

5.6 EDID SIGINAL SPECIFICATION

(1) EDID Power

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Absolute Maximum Ratings	Vcc		0	—	7.0	V
Recommended Operating Conditions	Vcc	Read Operation	2.2	—	5.5	V



(2) DC characteristics

		Symbol	Min.	Max.	Unit	Remark
SCL, SDA terminal input voltage	High Voltage	VIH	0.7×Vcc	—	V	
	Low Voltage	VIL	—	0.3×Vcc	V	
Hysteresis Voltage		VHYS	0.05 VCC	—	V	
Output Voltage		VOL1 VOL2	—	0.4 0.6	V	IOL=3mA, CC=2.5V IOL=6mA, CC=2.5V
Input Leak current (Vin =0.1V~VCC)		ILI	-10 -10	10 50	uA	WP=VSS WP=VCC
Output Leak current		ILO	-10	10	uA	Vout =0.1V~VCC, WP=VSS
Terminal capacity(Input, Output)		Cin, Cout	—	10	pF	VCC=5.0V Ta=25^{0}C, Fclk=1.0MHz
Operating current		ICC Write ICC Read	—	3 1	mA	VCC=5.5V, SCL=400KHz
Stillness current (SDA=SCL=VCC) (WP=VSS,A0,A1,A2=VSS)		ICCS	—	30 100	uA	VCC=3.0V VCC=5.5V

(3) AC characteristics (VCC=2.5~5.5V standard operation mode)

Item	Symbol	VCC=2.5V-5.5V (Standard operation mode)		VCC=4.5V-5.5V (High-speed operation mode)			
		Min.	Max.	Min.	Max.	Unit	Remark
Clock frequency	Fclk	—	100	—	400	KHz	
Clock High Time	THIGH	4000	—	900	—	ns	
Clock Low Time	TLOW	4700	—	1300	—	ns	
SDA, SCL falling time	TR	—	1000	—	300	ns	
SDA, SCL rising time	TF	—	300	—	300	ns	
START hold time	THD: STA	4000	—	600	—	ns	
START setup time	TSU: STA	4700	—	600	—	ns	
Data input hold time	THD: Data	0	—	0	—	ns	
Data input setup time	TSU: Data	250	—	100	—	ns	
STOP setup time	TSU: STO	4700	—	600	—	ns	
Output decision time from a clock	TAA	—	3500	100	900	ns	
Bus free time	TBUF	4700	—	1300	—	ns	
Rising time of Min VIH, VIL	TOF	—	250	20	250	ns	CB≦100pF
Spike oppression	TSP	—	50	—	50	ns	
A write-in cycle time	TWR	—	10	—	10	ms	Byte and page mode
The number of times of data rewriting	—	1M	—	1M	—	cycles	VCC=5.0V Ta=25^{0}C,

(4) Device Addressing

Device Code				Slave Address			R/W
				A2	A1	A0	
1	0	1	0	0	0	0	R/W

6. INTERFACE TIMING

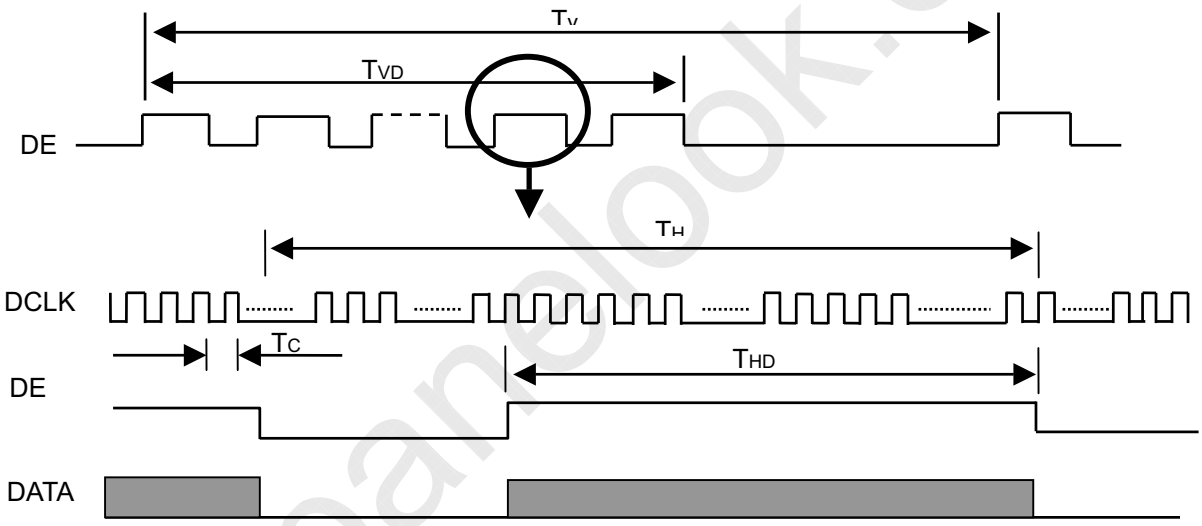
6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

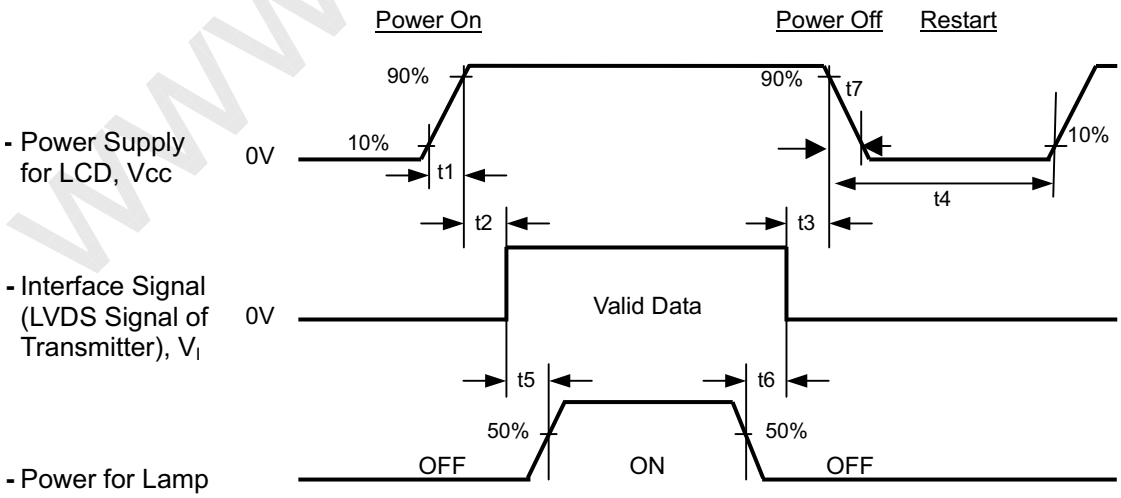
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	50	65	68	MHz	-
DE	Frame Time Cycle	TV	771	806	850	TH	-
	Vertical Active Display Period	TVD	768	768	768	TH	-
	One Line Scanning Time Cycle	TH	1200	1344	1500	Tc	-
	Horizontal Active Display Period	THD	1024	1024	1024	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0 ≦ t1 ≦ 20 ms

0 < t2 ≦ 50 ms

0 < t3 ≦ 50 ms

t4 ≧ 200 ms

t5 ≧ 100 ms

t6 ≧ 0 ms

0 ≦ t7 ≦ 10 ms

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

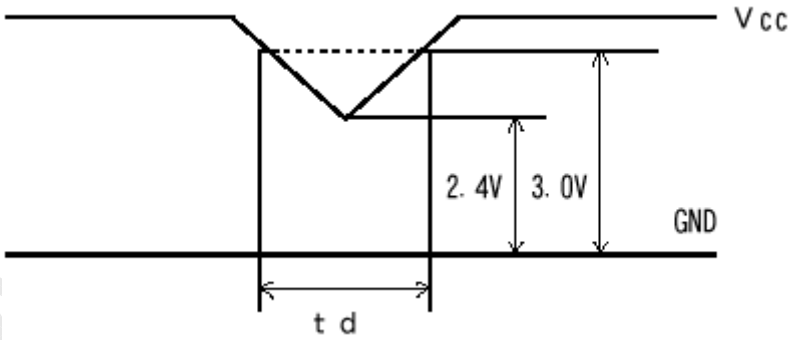
Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow

t7≧5 msec

Note (5) To avoid in-rush current is too large when power on. CMO suggest t1 should be larger than 470us when power on.

6.3 MOMENTARY VOLTAGE DROPS



(1) When 2.4V ≦ Vcc <3.0V and td≦10ms , the unit must work normally when VCC return to 3.0V.

(2) When Vcc < 2.4V, momentary voltage shall conform to the input voltage sequence.

7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

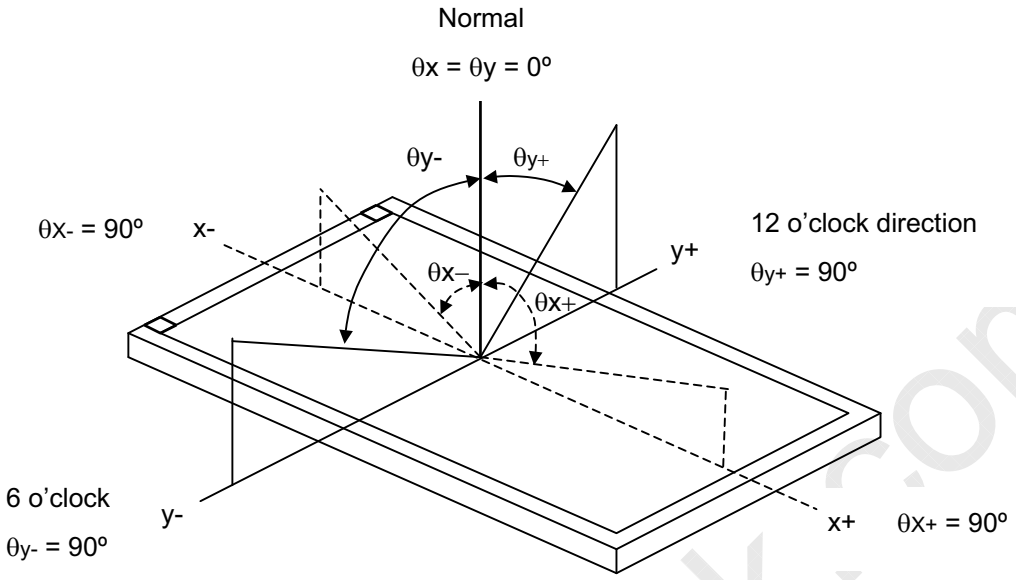
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	6.0	mA
Inverter Driving Frequency	F_L	60	KHz
Inverter	H05-4915		

The relative measurement methods of optical characteristics are shown in 6.2. The following items should be measured under the test conditions described in 6.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	θ_x=0°, θ_Y =0° Viewing Normal Angle (CS-1000T)	TYP -0.03	0.641	TYP +0.03	-	(1), (6)
		Ry			0.348		-	
	Green	Gx			0.285		-	
		Gy			0.604		-	
	Blue	Bx			0.143		-	
		By			0.067		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
	Color Gamut	C.G%		-	72%	-	%	(9)
Central Luminance of White		L_5		420	500	-	cd/m^2	(4), (6)
Contrast Ratio		CR		400	600	-	-	(2), (6)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	4	9	ms	(3)
		T_F		-	12	17	ms	
Cross Talk		CT	θ_x=0°, θ_Y =0° (BM-5A)	-	-	4.0	%	(5), (6)
White Variation		δW_A		70			%	(6), (7), (8)
		δW_B		70			%	
Viewing Angle	Horizontal	θ_x+	CR≥10 (BM-5A)	50	60	-	Deg.	(1), (6)
		θ_x-		50	60	-		
	Vertical	θ_Y+		30	40	-		
		θ_Y-		50	60	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

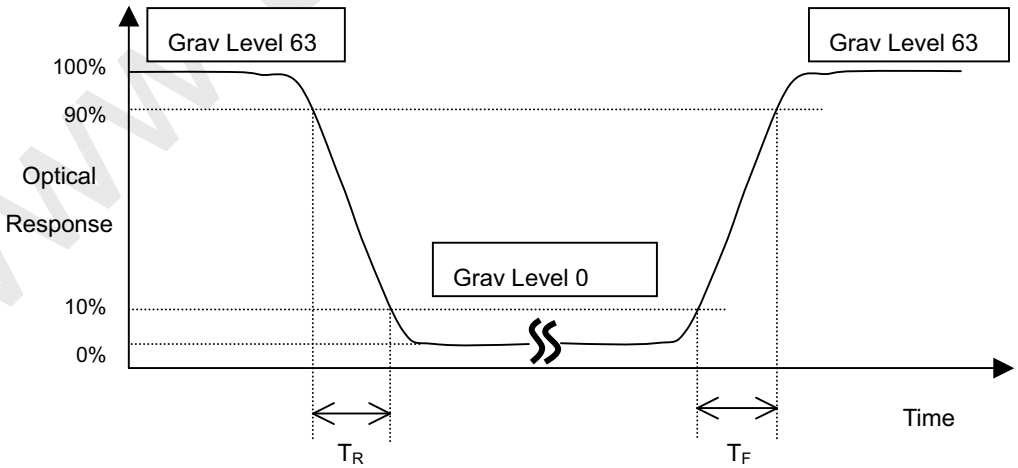
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Central Luminance of White (L_5):

Measure the luminance of gray level 63 at point X

$L_5 = L(5)$

L (x) is corresponding to the luminance of the point X at Figure in Note (7).

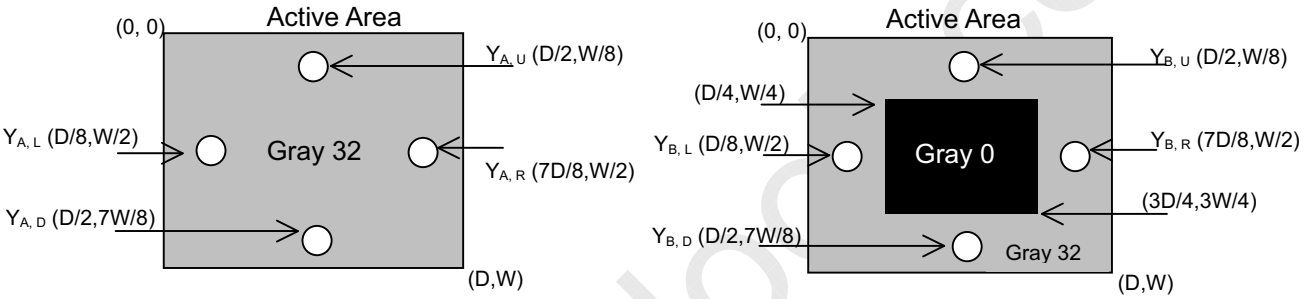
Note (5) Definition of Cross Talk (CT):

$CT = | Y_B - Y_A | / Y_A \times 100\ (\%)$

Where:

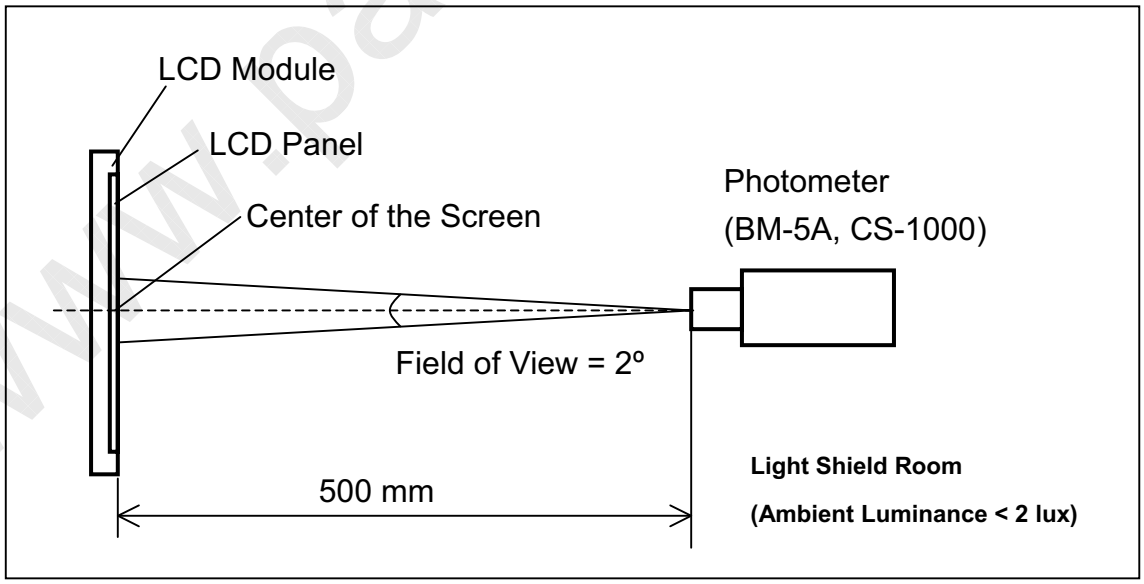
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

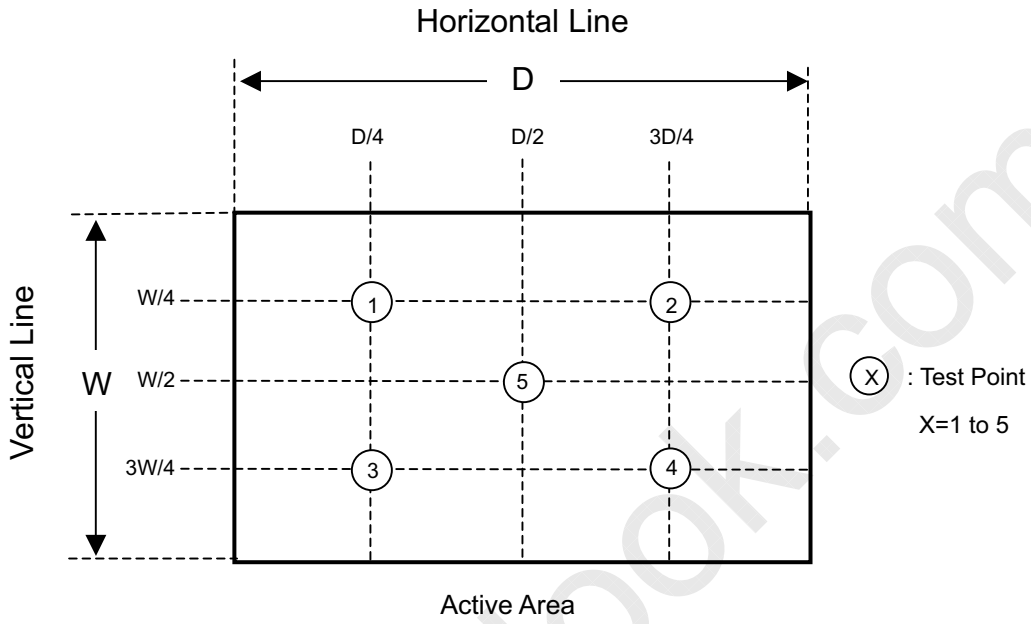
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]



Note (8) Definition of White Variation (δW_A):

Measure the luminance of gray level 63 at any point of range A on active display area

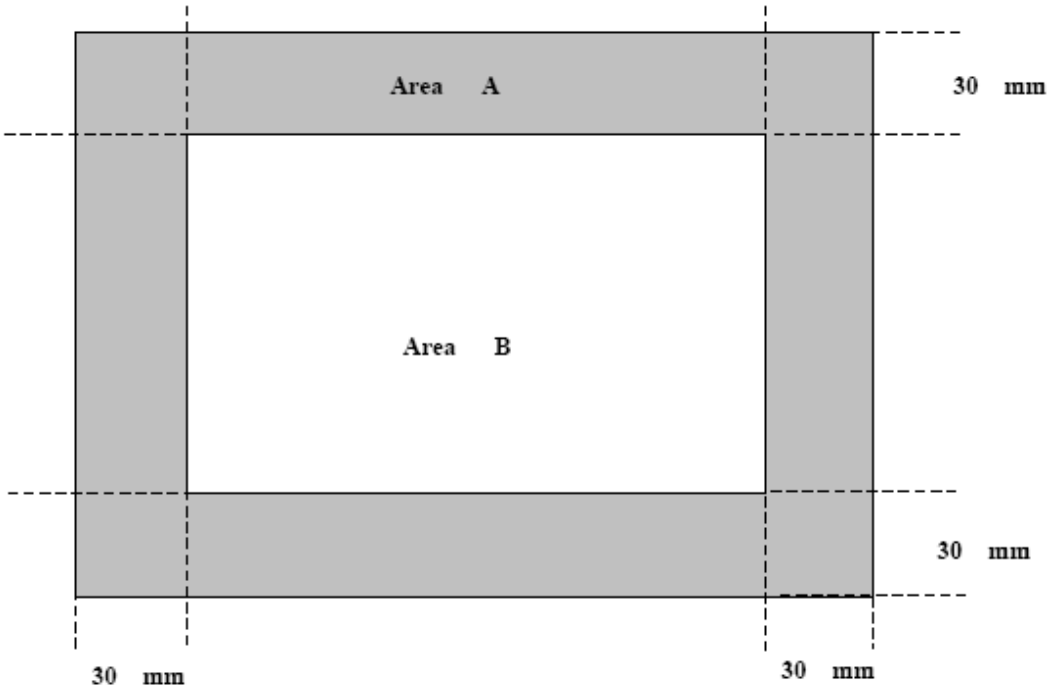
δW_A = Minimum [L(Any point of area A)] / Maximum [L(Any point of area A)]*100 %

Definition of White Variation (δW_B):

Measure the luminance of gray level 63 at any point of range B on active display area

δW_B = Minimum [L(Any point of area B)] / Maximum [L(Any point of area B)]*100 %

δW_B = Minimum [L(Any point of area B)] / Maximum [L(Any point of area B)]*100 %



Note (9) Definition of color gamut (C.G%):

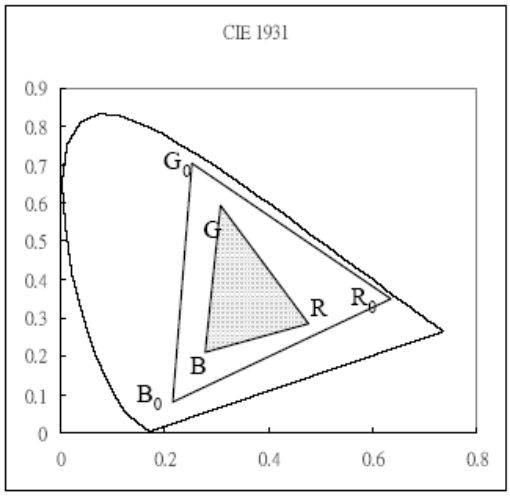
C.G%= △R G B /△R_0 G_0 B_0,

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 255 gray levels of red, green, and blue, respectively.

△R_0 G_0 B_0 : area of triangle defined by R_0, G_0, B_0

△R G B: area of triangle defined by R, G, B



8. PRECAUTIONS

8.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(10) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

8.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

9. PACKING

9.1 PACKING SPECIFICATIONS

(1) 15 LCD modules / 1 Box

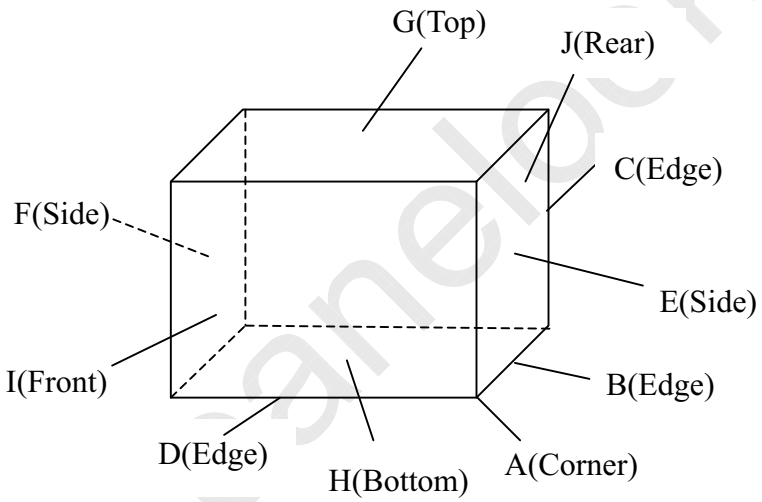
(2) Box dimensions : 511(L) X 420(W) X 360(H) mm

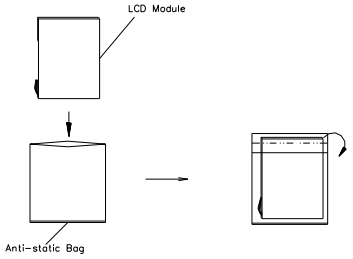
(3) Weight : approximately 14.7 Kg (15 modules per box)

9.2 PACKING METHOD

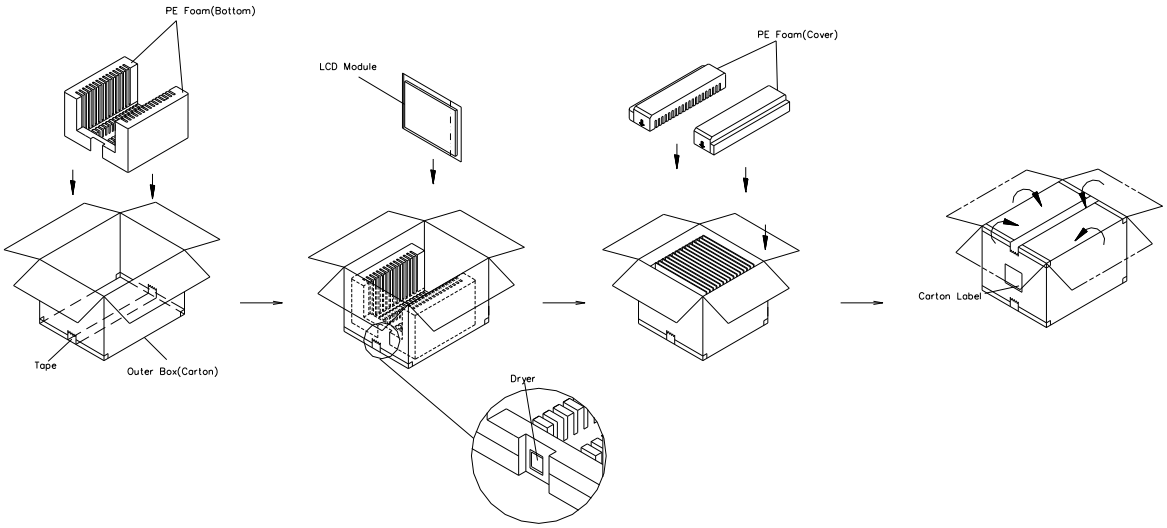
(1)Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	Random, 2-200 Hz, follow ISTA standard	Non Operation
Dropping Test	1 Angle (A), 55cm 3 Edge (B、C、D), 55cm 6 Face (E、F、G、H、I、J), 65cm	Non Operation

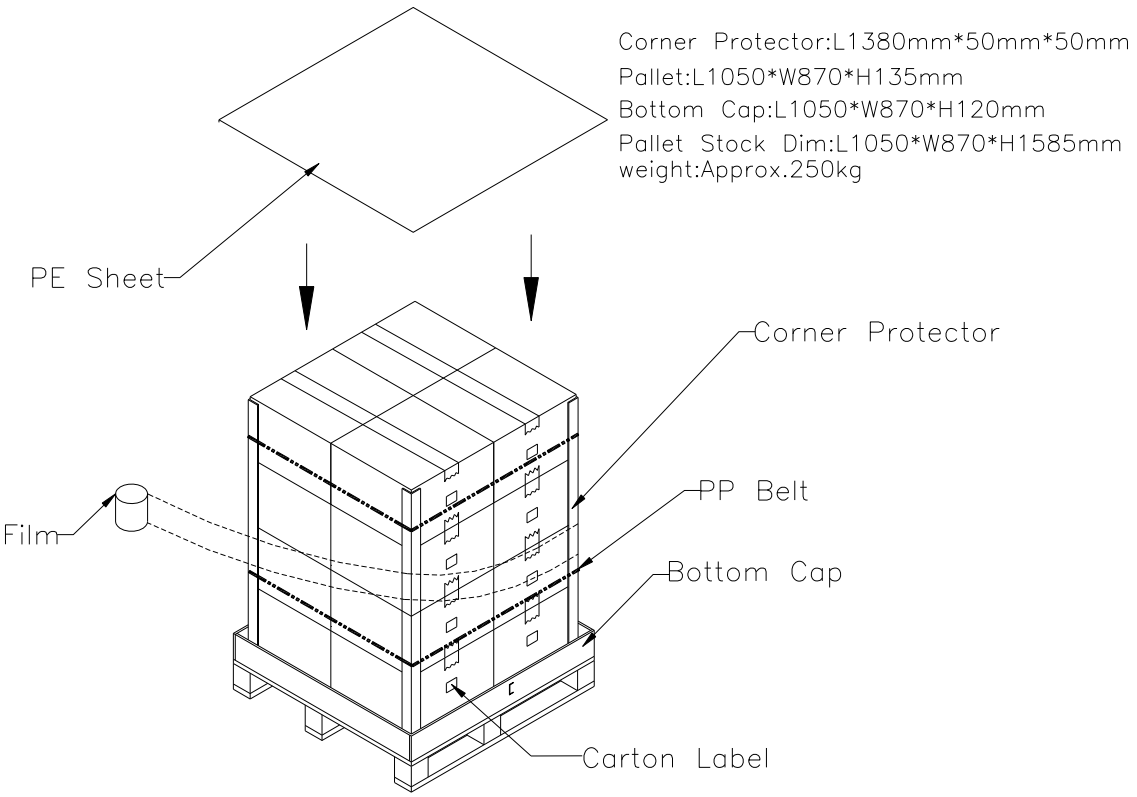




Box Dimensions: 511(L)x420(W)x360(H)mm
Weight : Approx.14.7kg(15 module.per.1 box)



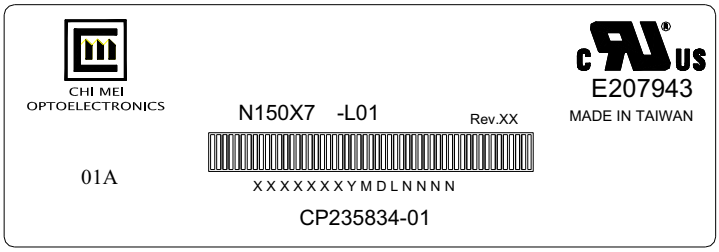
PALLET



10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



(a) Model Name: N150X7 - L01

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

(c) Serial ID: X X X X X X Y M D X N N N N

- Serial No.
- CMO Internal Use
- Year, Month, Date
- CMO Internal Use
- Revision
- CMO Internal Use

(d) Customer Internal Product Code : CP235834-01

(e) Customer Internal Revision : XXX, for example: 01A, 02A …etc

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

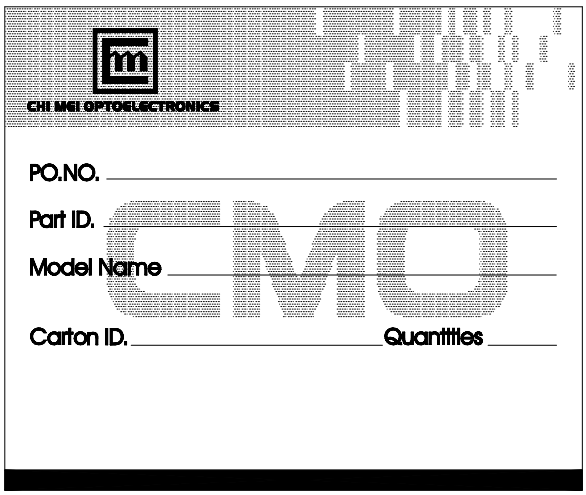
Month: 1~9, A~C, for Jan. ~ Dec.

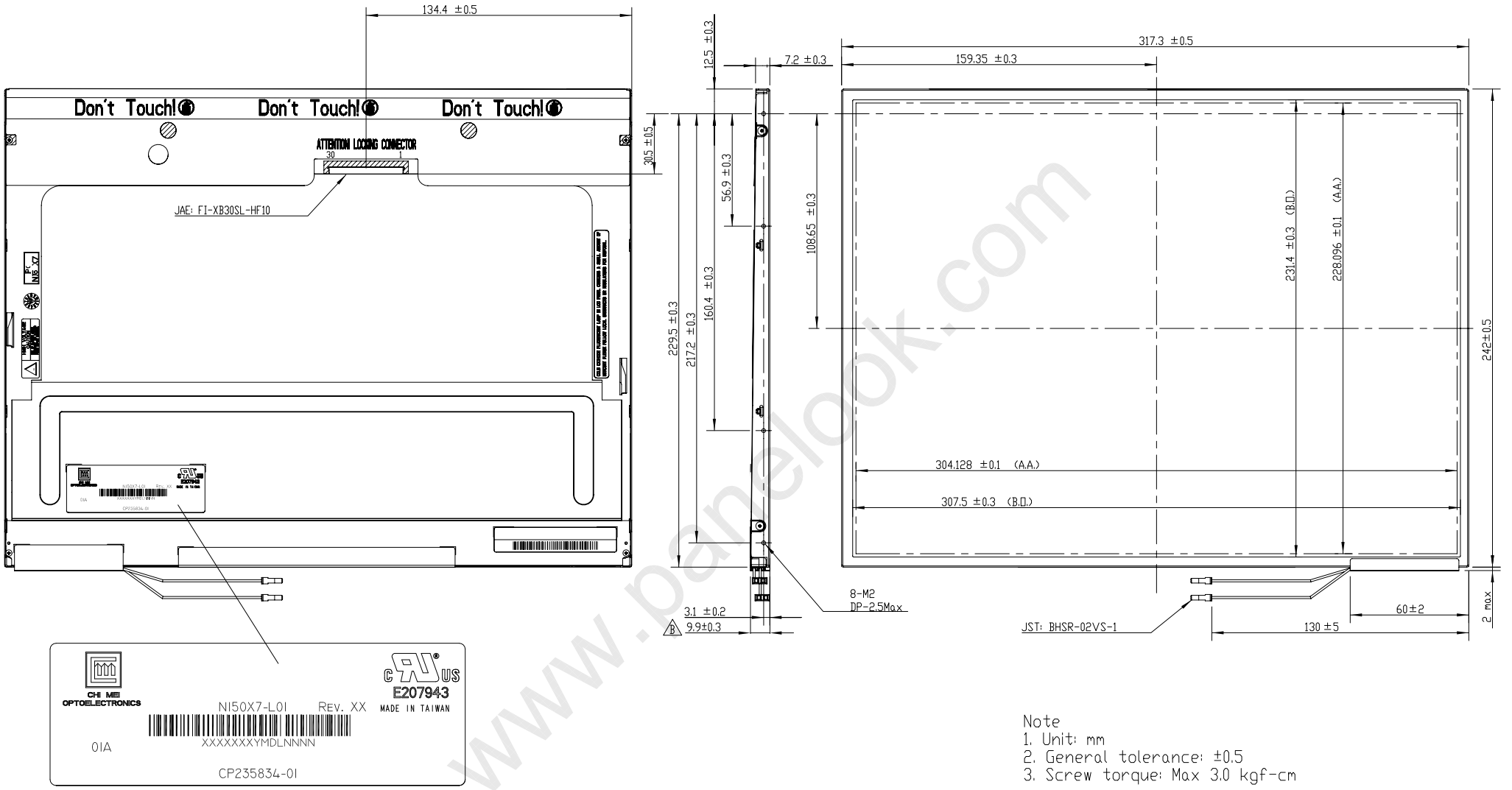
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

10.2 CARTON LABEL





Note
1. Unit: mm
2. General tolerance: ±0.5
3. Screw torque: Max 3.0 kgf-cm

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark
B	CHANGE DIMENSION	2005/06/01	HSINHUNG_CHEN	DAVIS_WANG		

TITLE	ASSY_MODULE_NF0X701901 (N150X7-L01)				2D REV.	B
					3D REV.	1.14
Approved	BILL_SHEU	Drawing No.	N15084101B			
Checked	YULE_LIN	Part No.				
Drawer	HSINHUNG_CHEN	Material	TBD	Sheet	1 / 1	A3
Designer	HSINHUNG_CHEN	Date	16-Sep-2004	Scale	1:1	Unit:mm

CHI MEI OPTOELECTRONICS CORP.